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EFFECTS OF GROUNDNUT HULLS BASED DIET ON PERFORMANCE AND HAEMATOLOGICAL INDICES IN JAPANESE QUAILS (*Cortunix cortunix Japonica*)

[1]Adeyina, A.O., [1]Akanbi, A.S., [2]Alabi, O.O., [2]Olawoye, S.O., [2]Soyombo, A.J. and [2]Animashahun, R.A.

[1]Department of Animal Production, University of Ilorin, Ilorin, Nigeria.
[2] Department of Animal Science, Landmark University, Omu Aran, Nigeria
Correspondence E-mail: aadeyina@unilorin.edu.ng. aadeyina@yahoo.com

ABSTRACT

The performance and haematological profile of Japanese quails (Coturnix coturnix japonica) fed with graded levels of groundnut hulls meal (GH) was determined. Four treatments: 0% (feed with zero supplementation of GH), 2.5%, 7.5% and 10% respectively, were utilized in a completely randomized design (CRD). Sixty (60) 5 weeks old unsexed grower Japanese quails were used for the performance study. At the end of the 10 weeks of performance study, blood samples were obtained from 2 quails per treatment into plastic tubes containing the anti-coagulant ethylene diamine tetraacetic acid (EDTA) for the determination of PCV, Hb, RBC, WBC, MCHC, MCH and MCV). Results revealed that feed intake of quails were similar between control and GH diets up to 7.5% inclusion. Feed intake significantly ($p<0.05$) decreased at 10% inclusion level. Quails on 5% GH inclusion showed significant ($p<0.05$) increase in final body weight. WBC significantly ($p<0.05$) increased with increase in GH inclusions while the lymphocytes were significantly ($p<0.05$) higher in quails fed the control and 2.5%. GH at 5% inclusion showed improvement in performance and haematological values and it is therefore recommended.

Key words: Groundnut hulls, Japanese quails, performance and haematological profile

INTRODUCTION

The inclusion of agro-allied waste in diet of poultry is becoming adaptable due to its availability and phytochemical constituents responsible for optimal feed utilization (Obi *et al.,* 2016). Profitable livestock enterprise depends on availability and affordability of feedstuff (Adeyina *et al.,* 2014) that supports physiological growth and development. However, the cost of producing good quality feed that support appropriate physiological performance is on the increase in Nigeria. This is due to inadequate production of grains to meet human and livestock nutritional demands (Council for Agricultural Science and Technology, 2013). Several plant by-products have been assessed with respect to their effects on physiological performance and haematological parameters in poultry. Some of these include corn bran, wheat offal, rice husk, and cassava waste (Ani, *et al.,* 2013 and Priabudiman, 2011). Groundnut hulls are among agro allied waste with potentials for improving animal physiological performance. It is the by-product from processing of groundnut for human consumption. The offal is produced after splitting the seeds in an attrition mill to remove the shell (Van Doosselaere, 2013). Nigeria being a leading producer of groundnut in Africa (Ajeigbe *et al.,* 2014), coupled with the government intervention in restoring the nation's groundnut pyramid, there is the possibility of increasing the quantity of groundnut hull that can ensure availability and sustainability. Groundnut hulls are presently considered as waste and which when disposed, constitutes environmental hazards. The burning of this waste may also increase level of carbon in the atmosphere thereby affecting the ozone layer. Groundnut hulls consist of some unbroken seeds which could further increase its nutritional qualities that can meet the requirement of quail.

The Japanese quails have the potential to serve as an excellent and cheap source of animal protein for Nigerians (Babangida and Ubosi, 2006; Ani *et al*., 2009). In recent times, substantial research efforts have been made to domesticate some of these nonconventional micro livestock and to introduce them into areas where they were originally non-existent (Onyimonyi and Okeke, 2000). The fast growth rate, early sexual maturity, short generation interval, high rate of lay associated with quail would require affordable, sustainable feedstuff that can maintain the birds in physiological state of balance. In view of this, performance and haematological parameters of quails fed groundnut hulls were examined.

MATERIALS AND METHODS

The experiment was conducted at the Teaching and Research Farm, University of Ilorin, Ilorin, Kwara State, Nigeria with an average mean temperature of 32.5^{o}C and annual rainfall of about 900mm. Raw groundnut hulls (GH) were obtained from local groundnut processing cottage industry in Edu Local Government Area of Kwara state, Nigeria. The hulls were sun-dried to reduce fungi contamination and sorted to remove impurities before being milled into smaller particles sizes using a locally fabricated hammer milling machine. Samples of the hull meal were analyzed for proximate composition (Table 1). Five diets with comparable energy and protein were formulated with groundnut hull meal included at 0%, 2.5%, 5%, 7.5% and 10% levels to replace wheat offal (Table 2) in a completely randomized design experimental layout. Sixty, 5 weeks old Japanese quails from the Department of Animal production, University of Ilorin, were randomly grouped into five dietary treatments in cages. Each treatment had three replicates with 4 birds per replicate. Experimental diets and water were offered to the birds *ad libitum* under the natural day length of 14 hours over a period of ten weeks. At the end of the ten weeks, blood samples were obtained from the wind vein of two birds per replicate into bottles containing (EDTA) for haematological parameters.

Chemical analysis

Analysis of the nutrient composition of the groundnut hulls was carried out using the methods of AOAC (2000). Metabolizable energy of GH was calculated according to the method of Pauzenga (1985). Haematological indices were determined using modified haematology analyzer (HA) model 6000. Qualitative and quantitative phytochemical screening of the GH were carried out by the methods of Trease and Evans (1989).

Statistical analysis

All data were subjected to statistical analytical procedure using analysis of variance (ANOVA) following a completely randomized design (SAS,1996) and level of significance ($p<0.05$) were separated using Duncan multiple-range test (Duncan,1955).

RESULTS AND DISCUSSION

Proximate and phytochemical composition of groundnut hulls

The proximate composition of raw groundnut hull (GH) meal and the phytochemical analysis are shown in Tables 1 and 2. GH contained crude protein (8.5%) which is within the range of 7-15% reported by Singh and Diwakar (1993) and 2.75% ether extract. The crude fibre was lower than 60% reported by Aregheore, (2000). The improvement in values of nutrients in GH may be due to presence of whole or broken kernels and unshelled pod, making groundnut hulls potentially good feedstuff for quails. The phytochemical screening showed that GH contains alkaloids however; the levels were low to cause any deleterious effect which further qualifies GH as a potential feed ingredient. The composition of experimental diets and control as shown in table 3, revealed that the diets are isonitrogenous and isocaloric, thus meeting the requirement of quails

Table 1 Proximate composition of groundnut hulls (GH)

Parameters	(%)	SD
Dry Matter	87.80	±5.00
Moisture Content	12.20	±1.02
Crude Protein	8.50	±0.87
Ether Extract	2.75	±0.26
Crude fibre	31.80	±0.2
Ash	3.25	±0.57
NFE	44.09	±1.55
Metabolizable Energy	2065.38	

*Calculated value= (37×Crude protein)+(81.8×Ether extract)+(35.5×Nitrogen free extract), **(**Pauzenga, 1985).

Table 2 Phytochemical composition of groundnut hulls

Phytochemicals	**Qualitative**	**Quantitative (mg/100g)**
Alkaloids	+	0.82
Saponins	+	2.07
Tannins	+	0.17
Flavonoids	+	1.20
Steroids	+	1.08
Anthraquinones	+	0.96
Glycosides	+	0.90
Cardiac glycosides	+	0.74

Key + Present

Table 3 Dietary composition of experimental diets

Ingredients	**0%**	**2.5%**	**5%**	**7.5%**	**10%**
Maize	50	50	50	50	50
Soybean meal	25.60	25.60	25.60	25.60	25.60
Wheat offal	10	7.5	5	2.5	0
Groundnut hull	0	2.5	5	7.5	10
Fish meal	3	3	3	3	3
Bone meal	2	2	2	2	2
Groundnut cake	7.7	7.7	7.7	7.7	7.7
Oyster shell	1	1	1	1	1
Methionine	0.1	0.1	0.1	0.1	0.1
Lysine	0.1	0.1	0.1	0.1	0.1
Vitamin premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Calculated					
Crude Protein (%)	22.89	22.62	22.34	22.06	21.79
M.E(Kcal/kg)	2884.28	2887.75	2891.22	2894.64	2898.16

M.E: Metabolizable energy

Effects of groundnut hulls based diet on performance of quails

The performance characteristics of quails are shown in Table 4. The feed intakes of quails were not significantly ($p>0.05$) altered between control diet and GH based diets up to 7.5% inclusion level. However, the feed intake of quails fed with 10% GH inclusion was significantly ($p<0.05$) lower compared with other diets. The low feed intake may be due to poor acceptability and palatability (Afolabi *et al.,* 2012). The dull colour of the diet as well its bulky nature which could have resulted in rapid gut fill and low transit time at this level of inclusion may equally reduce the feed intake (Leeson *et al*., 2001). Quails fed with 5% GH had a significantly higher final weight while quails on other GH based diets had final weight comparable with the control. The final weight of quails deteriorated at 10% GH inclusion, however, the weights of the quails were higher than 157.98 grammes reported for matured quail by Ojo *et al*. (2014). The improvement in observed weight of quails fed with GH based diet could be due to presence of growth improvement factors as well as phytochemicals such saponin and phenol inherent in GH (Fawole, *et al.,* 2009). Saponin and phenols are anti-inflammatory substances that could reduce the diversion of nutrient from growth to immune response (Mohammed *et al*., 2014). The nutrients shifted to increased body mass leading to a higher weight gain. The feed to gain ratio (F:G) values for quails were not significantly ($p>0.05$) different among the experimental diets but, 5% inclusion of GH had relatively low value. The low F:G value is an indication of better utilization of the diet at this level.

Table 4 Effects of groundnut hulls on performance of quails

Parameters/GH inclusion (%)	0%	2.5%	5%	7.5%	10%	SEM
Initial weight (g)	124.83	124.00	124.67	124.42	124.92	
FI (g/bird/day)	10.31^{a}	10.71^{a}	10.69^{a}	10.65^{a}	9.6^{b}	2.83
FBW(g/bird/day)	165.67^{ab}	166.67^{ab}	171.75^{a}	167.83^{ab}	163.83^{c}	4.83
WG (g/bird/day)	0.68	0.71	0.78	0.72	0.65	0.08
Feed:Gain	15.16	15.08	13.71	14.79	14.77	0.76

IBW= Initial Body Weight, FI= Feed Intake, FBW= Final Body Weight, WG= Weight Gain.

Effects of groundnut hulls based diet on haematological indices of quails

The haematological parameters of quails fed GH is presented in Table 5. Dietary inclusion of GH significantly ($p<0.05$) affected some of the parameters observed. This is supported by Addass *et al*. (2012) who suggested that nutrition affects blood values of animals. White blood cell counts (WBC) increased as the levels of GH increased across the treatments. WBC is valuable in monitoring feed toxicity especially with feed constituents that affect blood as well as health status of farm animals (Oyawoye and Ogunkunle, (2004). This implies that GH is not toxic to the quails because the values of WBC are still within the normal range for quails. The values of lymphocytes are significantly ($p<0.05$) higher in quails fed the control and 2.5% GH. These values are above the value of 64.30% reported by Ashraful (2013). However, the lymphocytes value for quails fed 5% and 7.5% GH falls within the range of 35% - 55% and 64.3% Ashraful (2013). Quails on 10% GH diet had significantly ($p<0.05$) low lymphocyte. The variability in lymphocyte value may be due to different degree of stimulation of immune reaction in response to constituents of the diets (Ahamefule *et al*., 2008). The value of haemoglobin corroborates the result of Uchendu *et al.* (2010) as relatively safe value. This implies that GH based diets did not alter oxygen availability in the blood and the quails are not anaemic.

PCV values of quails fed GH based diets up to 10% are not significantly ($p>0.05$) different from one another and are within the range of 36.26% -51.74% reported by Onyinyechukwu *et al*. (2017) for healthy quails which confirmed that the oxygen circulation was not inhibited in the quails offered these experimental diets. The values of MCV observed corroborated 150(fl) recorded by Barde *et al.* (2017) for adult quails. The values of MCH and MCHC for quails observed are similar across the treatments and agrees with those reported by Barde *et al.* (2017).

Table 5 Effects of groundnut hulls on haematological parameters of quails

Parameters/GH inclusion (%)	0%	2.5%	5%	7.5%	10%	SEM
WBC ($\times10^{9}$/L)	27.25^{c}	21.55^{c}	36.60^{b}	45.25^{a}	37.30^{b}	9.05
LY (%)	72.10^{bc}	83.85^{c}	59.45^{abc}	47.95^{ab}	27.80^{a}	8.91
GRAN (%)	25.55^{ab}	14.64^{a}	36.30^{ab}	49.10^{bc}	69.55^{c}	8.52
RBC ($\times10^{12}$/L)	3.19	2.95	3.13	3.17	2.29	0.50
Hb (g/L)	151.50	143.50	152.00	153.00	141.50	13.18
MCV (fL)	146.50	143.00	150.00	149.00	142.50	5.41
PCV (%)	47.00	42.00	47.00	47.00	33.00	7.04
MCH (Pg)	47.25	48.85	48.55	48.35	74.70	13.59
MCHC (g/L)	322.50	344.50	324.00	324.00	526.50	99.82

WBC= White blood cell, GRAN= granulocyte, RBC= red blood cell, Hb= haemoglobin, MCV= mean corpuscular volume, PCV= parked cell volume, MCH= mean corpuscular haemoglobin, MCHC= mean corpuscular haemoglobin concentration. Superscript abc means values in the same row having different superscript are significantly different ($p<0.05$).

CONCLUSION

The finding from this study revealed that groundnut hulls produced an improvement in growth performance, feed: gain ratio and other parameters compared with the control diet. Based on these results, it is apparent that GH is an available crop waste with potentials that can be utilized in quails' diet without any deleterious effect on health status of the quails. However, inclusion at 5% is optimal and it is therefore recommended.

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